Small Business Innovation Research/Small Business Tech Transfer

Flexible Interconnecting NodEs for In-Space Structural Assembly (FINESS), Phase I

Completed Technology Project (2018 - 2019)

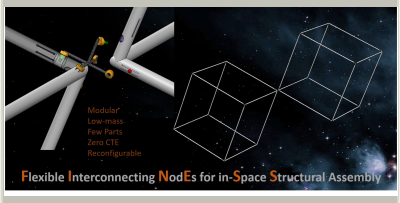
Project Introduction

In response to NASA's need for long-duration, low-mass in-space modular construction components, Roccor proposes to develop structural joints designed for rapid in-space assembly (iSA) and structural modularity. Trusses built of repeating unit-cell/modular elements can be assembled by connecting multiple modules to interconnecting joints. Implemented with embedded conductors for connection verification, power and data transmission, the proposed invention utilizes near zero CTE composite tubes with snap-fit connectors and a flexible joint for quick, repeatable construction and reconfiguration of trusses in space. The concenpt, Flexible Interconnecting NodEs for in-Space Structural Assembly (FINESS), will advance iSA opportunities through innovative features such as: 1) assembly connections at low-weight, low cost, and minimal part-count, 2) developing rigid plug-and-play joints for connecting modules in various arrangements, 3) integrating conductive elements for a fully connected structure with joint connection verification, and 4) near zero thermal expansion in carbon fiber tubes and connecting fixtures. The principal objective for the Phase I project is to conduct a preliminary design-analysis-fabrication-test loop for an electrically integrated modular truss joint. The project will clearly identify engineering risks that must be addressed to ensure acceptable performance on-orbit and in gravity loaded environments. Detailed mechanical and electrical design will be performed including investigation of attainable truss geometries, repeatable plug-and-play fastening mechanisms, material selection and conductive routing. The design efforts will be followed by local and global strength, stability and thermal analyses to describe the capacity of the modular joints. Furthermore, elements of the concept will be prototyped to test areas such as modular assembly and electrical continuity across joints.

Anticipated Benefits

The FINESS system fills critical gaps in current capabilities and aligns perfectly with some of NASA's recently established priorities: providing rapidly constructible structures implemented with electrical connectivity for routing power and data around joints, providing joint connection verification and providing a high degree of modularity at a small mass and stowage volume. The number of structural applications for the FINESS system really is endless due to its modular simplicity.

In addition to NASA's mission market, Roccor has identified other markets where advancements of the proposed FINESS system could have considerable impact: a) portable and man-packable constructible trusses for military ground troops, b) structural assemblies for lunar/Martian habitats and vehicles, c) rapid assembly of buoyancy devices in the absence of auto-inflation.



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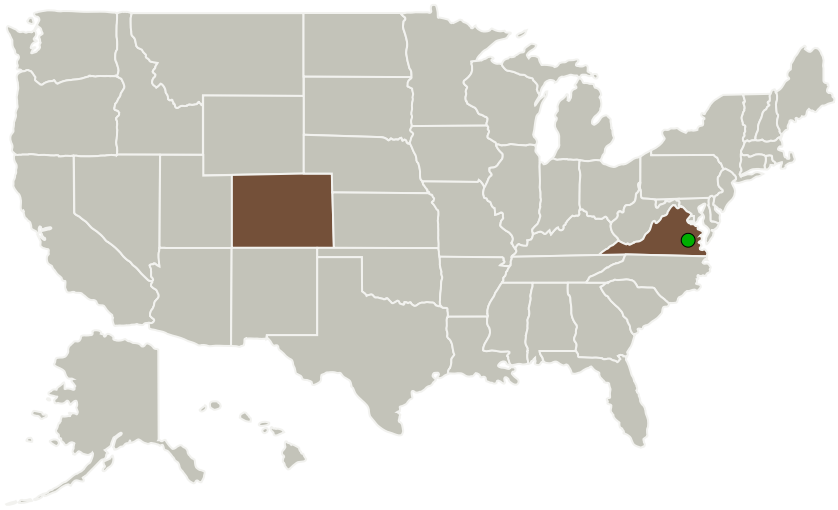
Completed Technology Project (2018 - 2019)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Roccor, LLC	Lead Organization	Industry	Longmont, Colorado
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Colorado	Virginia

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141347)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Roccor, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

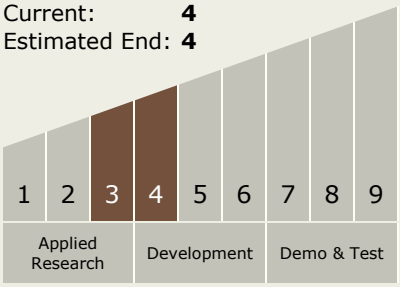
Carlos Torrez

Principal Investigator:

Kevin Cox

Technology Maturity (TRL)

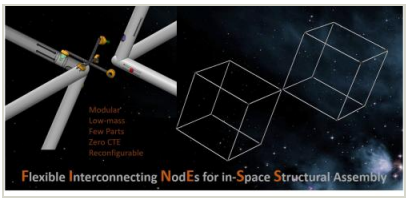
Start: **3**
Current: **4**
Estimated End: **4**



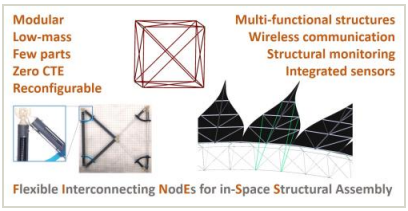
Flexible Interconnecting NodEs for In-Space Structural Assembly (FINESS), Phase I

Completed Technology Project (2018 - 2019)

Images



Briefing Chart Image
Flexible Interconnecting NodEs for In-Space Structural Assembly (FINESS), Phase I
(https://techport.nasa.gov/image/126024)



Final Summary Chart Image
Flexible Interconnecting NodEs for In-Space Structural Assembly (FINESS), Phase I
(https://techport.nasa.gov/image/136506)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials

Target Destinations

The Moon, Earth